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New Index for Salinity Assessment Applied on Saline Context Area (Case of the Lower Chéliff Plain)

Koulla Noureddine[a]*, Mokhtari Djamel Eddine[b], Douaoui Abd El Kader[c]

[a] *Institut of agronomic sciences, Hassiba Ben Bouali Chlef university. Es-Salem City, 19 national streets, 02000 Chlef, Algeria. Institut of agronomic sciences*

[b] *Laboratory of Ecology & Environment sciences, University of sciences & technology Houari-Boumedienne Algiers*

[c] *Laboratory of Agricultural production and sustainable development of natural resources. Khémis Miliana University*

Abstract

The plain of the lower Chéliff is located 220 km to the west of Algiers and extends over 60000 ha. This area is suffered by soil salinization in relation with various degradation levels. The remote-sensing data with salinity measured data of the ground surface has been used to evaluate the soil salinity using remote-sensing indices and apply a comparison the purpose index ISk. The correlation between the three applied indices have shown a good result in term of salinity assessment and made a better estimation of soil salinity.

Keywords: Salinity; indicator; remote sensing; Landsat TM; Lower Chéliff.

1. Introduction

Salinity is one of the most environmental issues affecting soil resources in the word [1, 2]. It causes severe environmental degradation that impedes crop growth and overall regional production [3, 4]. In Algeria, the salinity known an important increase at the last decade [5, 6], the lower Chéllif is one of the most heavily regions affected by soil salinity problems in Algeria, with further of 80% are [5], due to irrigation activities [6].

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* Corresponding author. Tel.: +213772222295.

E-mail address: koulla-033@hotmail.com.

Several indicators were used for the estimation of salinity by the use of remote sensing in the world [6,7,8,9].

The proposed salinity index (ISk Koulla) is applicable to make a good assessment based on acquire data in the visible and near-infrared satellite imagery bands. They have been used in our study area, especially in the context of salinity.

2. Materials and methods

2.1 Study area

The Lower Chéliff Plain, which encompasses over 60,000 ha in land area; it is located in the extreme northern part of the Chéliff Basin in Northwest Algeria, between longitudes 0°40 and 01°06′08″E and latitudes 34°03′12″and 36°05′57″N. The Lower Chéliff specific climate is of semi-arid with very hot summers, low winter temperatures and a mean annual rainfall of 250 mm [6].

2.2. Satellite image data

The choice of the image type referred from a satellite to another, For our study we used the raw image Landsat TM acquired in June 2006.

2.3. The soil sampling

The ground recognition and the sample selection test were carried out during one period being spread out over July 2006. Each sampling site was georeferenced and located on the ground by the use of a GPS into UTM projection (Zone 31 North, WGS 84). The full number of the 400 taken samples is distributed on all the plain.

2.4. The laboratory Analyzes

The analyzes at the laboratory were based on the measure of electric conductivity using diluted focal (1/5) for all 400 taken samples of the surface layer (0 - 20cm).

2.5. Salinity used indices

Three salinity indices were established using the same landsat TM satellite image (table 1)

3. Results and Discussions

In general, the three indices IS, NDSI, and ISK that were extracted from the Landsat satellite image were used for assessing the soil salinity for all 400 ground-measured samples.

The ISK indicator give a good correlation values 0,70 ; 0,75 respectively with IS, NDSI index. [6, 8]. (Table. 2). However, the results of Bannari and his colleagues [10], indicated that the NDSI index was a poor indicator for salt concentrations [4].

Table 1. Summary of soil salinity indices used

Index	**Formulation**	**Reference**
Normalized Differential Salinity Index (NDSI)	NDSI=(R − NIR)/(R+NIR)	[8]
Salinity Index (IS)	IS= $\sqrt{G^2 + R^2 + NIR^2}$	[6]
Salinity Index (ISK)	ISK= $\frac{\sqrt{(R-G)(R+G)}}{\sqrt{R^2+G^2}}$	The proposed salinity index (IS Koulla)

Table 2. Correlation between ISK and other soil salinity used indices

Index	NDSI	IS	ISK
Normalized Differential Salinity Index (NDSI)	1,00	0,63	0,75
Salinity Index (IS)	0,63	1,00	0,70
Salinity Index (ISK Koulla)	0,75	0,70	1,00

4. Conclusion

Overall, the IS, NDSI and ISk indices were useful for assessing the soil salinity. This study indicated that The Isk can be considered as a new index for salinity assessment, particularly in the context of salinity.

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